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Phytogeographical Excursion to the Surroundings of Lake Torneträsk in Torne Lappmark (Northern Sweden)

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SECTION: PHG

Phytogeographical Excursion to the Surroundings of Lake Torneträsk in Torne Lappmark (Northern Sweden).

By *G. Einar Du Rietz.*

I. The vegetation along the railway Stockholm—Abisko Östra.

A. The conifer forest region with oak.

The first part of the railway journey goes across the province of Uppland and Västmanland from Stockholm via Uppsala and Sala to Krylbo, through the northern part of the South-Swedish conifer forest region with oak. This region was previously often called »»the oak region», which easily gives the impression of a real oak forest region, or »the southern conifer forest region», which tells us nothing about the difference between this region and »the northern conifer forest region», or »the oak-conifer forest region», which stresses the importance of the oak in this region too much. Conifer forest of *Pinus silvestris* and *Picea Abies* occupies most of the forest area. Immixed are 1) the common deciduous broad-leaved trees *Betula verrucosa*, *B. pubescens*, *Populus tremula*, *Alnus glutinosa* (only in wet places), *Sorbus aucuparia*, *Salix caprea*, etc., 2) the more demanding southern

deciduous broad-leaved trees *Quercus Robur*, *Acer platanoides*, *Fraxinus excelsior*, *Tilia cordata*, *Ulmus glabra*, etc. Both groups of deciduous trees occasionally form groves without conifers, the former group on all sorts of soils, the latter group only on the better soil types. The region in question is a transition region between the oak and beech forest region without conifers that occupies great parts of western Europe including a narrow zone along the southern and western coast of Sweden.

The railway passes several eutrophic lakes with high and dense *Phragmites* etc. Between Sala and Krylbo we shall see the first oligotrophic lakes, with only low and light *Phragmites* and with much *Lobelia Dortmanna* on the boulder shore both below and above the water level.

B. The conifer forest region without oak.

1. The natural Norrland border.

At Krylbo, where the railway crosses the river Dalälven, it also crosses the northern limit of *Quercus Robur* and enters the conifer forest region without oak that occupies the greater part of North Sweden. The border between these two major vegetation regions is one of the most important biogeographical border lines in Sweden and indeed in the whole of Fennoscandia. Within a comparatively narrow zone many southern plant and animal species and biocoenoses reach their northern limits, and many northern plants and animal species and biocoenoses reach their southern ones. The cause of this concentration of biogeographical limits lies in an analogous con-

centration of isotherms and other climatic demarkations owing to the transition often quite abrupt, from the low plains of the southern parts of Svealand (Götaland, Svealand and Norrland are three historical main divisions of Sweden) to the hilly landscape of northern Svealand (Dalarne, northern Västmanland and Värmland) and Norrland. This remarkable geographical border was called »the southern limit of the Norrland terrain» by Sten De Geer (1910, 1918, etc.), »limes norrlandicus» by Rutger Sernander (in Du Rietz 1933, comp. Fries 1948) and »the ecological Norrland border» (Swedish: biologiska norrlandsgränsen) by myself (Du Rietz 1935). The term last mentioned has been misunderstood by some recent authors who have taken it to mean something narrower than the term »limes norrlandicus», or merely »a border of biogeography» (Sjörs 1950a pp 173—174). I have therefore decided to change the term to »the natural Norrland border» (Swedish: naturliga norrlandsgränsen). Whereas the southern border of the historical concept Norrland lies between the provinces of Dalarne and Uppland on one hand, Härjedalen, Hälsingland and Gästrikland on the other hand, the natural southern border of North Sweden or Norrland must be drawn as summarized above. The reason why I cannot accept the term »limes norrlandicus» for »the border of physical geography» (Sjörs l.c.) which I previously called »the ecological Norrland border» and am now calling »the natural Norrland border», is that the former term, »the limit of Norrland», gives us no idea of that what is meant is not the historical Norrland border mentioned above, but a natural Norrland border very different from it.

Along the southern coast of the Bothnian Sea the natural Norrland border curves up along the low coast district of the province of Gästrikland, which has some occurrences of *Quercus Robur* (comp. Du Rietz 1925 a, 1935). *Fraxinus*, which is possibly a still better indicator of the natural Norrland border than the oak, goes up still further North on the coastal plain of Gästrikland and Hälsingland.

2. The North-Swedish Acer—Tilia—Corylus subregion.

This subregion was called »regio Norrlandica (Acerina)» by Wahlenberg (1826) and »Lövträdens region»[1] by Elias Fries (1856, 1864). It occupies a coastal zone of southern Norrland (in the southernmost part inside the projecting conifer region with oak) up to the vicinity of Örnsköldsvik in northern Ångermanland and also extends narrow arms northwestwards into the lower valleys of Dalälven and other rivers. Many southern plants lacking in the more northern and western parts of Norrland occur in this subregion, especially at the foot of sunny precipices, e.g. *Acer platanoides*, *Tilia cordata* and *Corylus avellana* (comp. the maps in Hultén 1950).

Though the southern deciduous broad-leaved trees grow only scattered in the natural vegetation, they dominate in the cultivated treeflora in the towns, along roads etc. Especially *Acer platanoides* sets its stamp upon the culture landscape (comp. the name given by Wahlenberg to this region!). Even *Quercus Robur* is planted in this subregion (rather big trees as far North

[1] = the region of the broadleaved trees.

as in Örnsköldsvik and as far inland as in Ånge), where it can produce plenty of ripe fruits in abnormally warm years. In the town of Söderhamn (at the coast of southern Hälsingland) their even grows a big tree of *Fagus silvatica*. Many southern kinds of fruit trees can be grown here but not in the other parts of the conifer region without oak. The railway passes through this subregion in the southeastern corner of Dalarne, in Gästrikland (where it even cuts the northwestern-most projection of the conifer region with oak) and southern Hälsingland. In northern Hälsingland, where the line runs northwestwards, it enters the next subregion.

3. The North-Swedish Myrica subregion.

This subregion was called »Regio sylvatica (extra-vel) infra-lapponica (Myricae)» by Wahlenberg and »Porsens[1] region» by Elias Fries (1856, 1864). It occupies the northern coastal zone of Norrland (N of the Örnsköldsvik district) and the greater part of the interior of southern Norrland (in a natural history sense, including Dalarne) E. of the mountain range. Many southern plants of the *Acer-Tilia-Corylus*-subregion (esp. those mentioned in its name) are absent in the wild vegetation of the *Myrica* subregion. In the cultivated tree flora, *Acer platanoides*, *Tilia*, *Ulmus glabra*, etc. still occur in this subregion (a considerable number of rather large trees are found as far North as in Umeå at the coast and as far West as in Östersund in southern Norrland, and single trees are kept alive still

[1] »Pors» is the Swedish name for *Myrica Gale*.

further North along the coast). But the main impression of the towns (even Umeå) is not that of »*Acer* towns» as Örnsköldsvik, Härnösand, Sundsvall, etc., but that of »*Betula* towns» (with *Sorbus Aucuparia* in the second place). Many southern plants common in the *Acer-Tilia-Corylus* subregion are important constituents of the vegetation also in the *Myrica* subregion but absent or very rare in the next subregion. Foremost among them is *Myrica Gale*, which may be seen from the train and which is very common and abundant in mire margins as well as on lake and sea shores along the coast of Västerbotten, and the distribution area of which includes also a narrow coastal zone in Norrbotten as well as the greater part of the interior of southern Norrland (comp. map 589 in Hultén 1950). *Alnus glutinosa* also occurs along the whole coast of Norrland but is absent in the interior (Hultén 1950 map 598). Other southern plants widespread in this subregion but absent in the next are *Rhynchospora alba* (Hultén's map 312), *Calla palustris* (Hultén's map 421), etc. The railway passes through this subregion from where it leaves the *Acer-Tilia-Corylus* subregion in Hälsingland, through western Medelpad (Ånge), eastern Jämtland (Bräcke), Ångermanland (Långsele, Mellansel) and Västerbotten (Vännäs etc.) until it enters the next subregion in Norrbotten somewhere S. of Boden.

4. The central North-Swedish conifer forest subregion.

This subregion was called »Lapponia sylvatica inferior» by Wahlenberg (1812). It differs from the *Myrica* subregion by the nearly complete absence of

Myrica and many other southern plants as well as by the higher frequency of plants belonging to the mountain flora, especially by the greater abundance of »grey willow scrub» formed by *Salix glauca* and *S. lapponum* in mire margins, on lake and river shores etc. From the railway this subregion can be seen most typically between Boden and Gällivare.

5. The prealpine conifer forest subregion.

This subregion, the »Lapponia sylvatica superior» of Wahlenberg (1812), differs from the one last mentioned by the still greater scarcity of southern plants and the still greater abundance of mountain plants as well as by the often decreasing density of the upper tree layer formed by the conifers above a denser lower tree layer formed by birches that are at least very nearly related to the mountain birch, *Betula pubescens* subsp. *tortuosa*. The subregion is horizontally differentiated into two subordinate subregions:

a. *The prealpine conifer forest subregion with both pine and spruce.* This subregion can be studied from the train between Gällivare and Kiruna. At Gällivare, the first fjäll (the Swedish name of a mountain with a bare summit above the forest limit) is seen from the train on the western side. On the slopes of this fjäll, Mt Dundret, a typical prealpine spruce forest can be seen as well as in many other places along the railway.

b. *The prealpine pine forest subregion without spruce* (Wahlenberg's *regio subsylvatica Pinu sylvestri*). In northern Lappland the western limit of *Pinus silvestris* lies a good distance W. of that of *Picea Abies*. Along the

railway, the last spruces are seen just NW. of Kiruna, whereas the last pines on the Swedish side grow as far West as in the Abisko valley.

No other conifers than *Juniperus communis*, *Picea Afies* and *Pinus silvestris* are wild in Scandinavia.

C. The subalpine birch forest region or belt.

Above the upper limit of the conifer forest belt, the mountain birch (*Betula pubescens* subsp. *tortuosa*) forms a forest belt, the *Regio subalpina (Betulina)* of Wahlenberg. From the railway this belt is first seen on the slopes of Mt Dundret SW. of Gällivare. On this mountain, as well as on other mountains in the East, scattered spruces and pines are found throughout the birch forest belt, whereas in the central part of the mountain range there is a broad pure birch forest belt, above the uppermost conifer trees. Between Gällivare and Kiruna, where the railway reaches its highest point, 550,9 m above sea level, it runs for a while through the subalpine birch forest belt. Here in clear weather the high mountains of the Kebnekaise massiv (the highest in Sweden) are visible from the train. Just N. of Rautas (467 m above sea level, half-way between Kiruna and Lake Torneträsk) the railway again ascends above the conifer forest line, which is here formed by pines only. Between the stations Bergfors (485 m above sea level) and Torneträsk (393 m) the railway descends again in the prealpine pine forest region, which has its western limit just W. of the railway station Stenbacken (381 m). Between Stenbacken and Abisko Östra (390 m) the railway runs through

typical subalpine birch forest. The pine forest of the Abisko valley is an isolated outlier of the prealpine forest region.

II. The vegetation of the Torneträsk district.

A. The pine forest region of the prealpine belt.

Patches of *Pinus silvestris* forest are scattered over large parts of the Abisko valley. *Empetrum hermaphroditum*, the only *Empetrum* species of this part of Scandinavia, is the most important dominant in the field layer. The reproduction of the pines has improved considerably during the warm period of the last decades. Comp. Arnborg 1950 p. 31—32.

B. The subalpine birch forest belt.

This belt extends from the shore of Lake Torneträsk (312 m) up to ca. 600—650 m in the West and up to ca. 750—800 m in the East.

In the lower subalpine belt the birch forest is generally rather closed except for open areas caused by solifluction, mires, steep rocks, talus slopes, avalanches, etc.

In the upper subalpine belt the birch forest is absent in large areas owing not only to the causes mentioned above but also to late snow or insufficient snow-protection in winter. The birch forest occupies only the optimal habitats and is often reduced to isolated patches or even isolated trees or shrubs. The uppermost shrubs of pure *Betula pubescens* subsp. *tortuosa*

(not of its hybrid with *B. nana*, which may grow higher up) on very windexposed localities without any forest seem to reach about the same altitude as the uppermost birch trees or birch forests do in more sheltered places with optimal snow conditions. The *Salix* and *Betula nana* shrubs, dwarf-shrub heaths, grass-heaths, meadows etc. growing between the isolated uppermost birch trees or birch shrubs are very similar to those of the lower alpine belt, but they normally differ by containing several subalpine components, and seem to be most naturally included into the subalpine vegetation.

On well watered ground the birch may be largely or completely replaced by *Salix* (*nigricans* subsp.) *borealis* or *Alnus incana*. *Sorbus aucuparia* is a common tree in the birch forest, and often ascends as high as the birch. *Populus tremula* and *Salix caprea* may also occur in the birch forest. Tall shrubs of *Prunus padus* often occur in meadow birch forest. Lower shrubs of several *Salix* species, *Betula nana* and *Juniperus communis* are common. *Ribes spicatum* (= *rubrum*) often occurs in meadow forests.

Most of the birch forest is a heath birch forest on strongly acid soil with *Empetrum hermaphroditum* and *Vaccinium Myrtillus* as main field layer dominants and with mosses dominant in the bottom layer. This *Myrtillion* birch forest may be divided into one *Empetro-Myrtilletum* association on drier ground, one *Eumyrtilietum* on somewhat better soil and one *Geranio-Myrtilletum* association (with *Geranium silvaticum* and other meadow herbs) on still better soils. In places kept moist by moving water, especially on calcareous soil, the heath forest is replaced by a meadow birch for-

est with tall herbs (*Geranium silvaticum*, *Trollius europaeus*, *Lactuca alpina* etc.) dominant in the often very luxuriant field layer and with practically no *Vaccinium Myrtillus*. Owing to the absence or scarcity of earth worms, no mull is formed, not even in the richest meadow forest, but a circumneutral raw humus or rather meadow peat (Du Rietz 1945). As to meadow birch forest rich in ferns see Runemark 1950. Fen birch forests of various types also occur. Comp. Du Rietz 1942 b p. 174, where also other types of birch forest are described.

As to the mires in the subalpine belt comp. Du Rietz 1942 b, 1949, Witting 1949 and Persson 1950.

C. The low alpine belt.

This belt has often been called a willow scrub belt, and it is true that grey willow scrubs of *Salix glauca*, *S. lapponum* and *S. lanata* cover large areas on moist ground in the lower parts of the belt together with *Betula nana* scrubs, etc. But there is never a continuous willow scrub belt. On more dry and sunny slopes *Juniperus communis* scrub often takes the place of the willow scrub. Most of the area in the low alpine belt is occupied by a dwarf-shrub heath with *Empetrum hermaphroditum*, *Betula nana* and *Vaccinium Myrtillus*, or on calcareous soil *Dryas octopetala* and *Cassiope tetragona* are the most important dominants, and the belt is best characterized as a dwarf-shrub heath belt. Grass-heath, meadow, and dwarf willow communities also cover considerable areas.

The poor heath vegetation usually covers the greatest part of the area, differentiated as follows.

1. *The Empetrion alliance.* Main dominants: *Empetrum hermaphroditum* and *Betula nana.* Other dominants: *Arctostaphylos alpina*, *Diapensia lapponica*, *Loiseleuria procumbens*, *Vaccinium uliginosum*, *V. Vitis-idaea.* No *Vaccinium Myrtillus*, *Deschampsia flexuosa*, *Solidago Virgaurea*, *Trientalis europaea* or other plants demanding good protection by snow in winter. Grows on very wind swept hills, ridges and plateaus with insufficient snow cover in winter. Comp. Du Rietz 1942 a and b.

2. *The Myrtillion alliance.* Main dominant: *Vaccinium Myrtillus.* Other dominants: *Phyllodoce coerulea*, *Empetrum hermaphroditum* and *Betula nana. Deschampsia flexuosa*, *Solidago*, *Trientalis* and other grass and herbs immixed. Grows on places well protected by snow in winter but laid bare early in the vegetation period. On the border to the *Empetrion* there is normally a belt of *Betula nana*, *Juniperus communis* or *Salix* scrub, indicating optimal snow conditions. Comp. Du Rietz 1942 a and b.

3. *The Deschampsio-Anthoxanthion alliance.* Main dominants: *Deschampsia flexuosa* and *Anthoxanthum alpinum.* On places with a snow-cover lasting too long for the *Myrtillion.* Comp. Gjaerevoll 1950.

4. *The Herbaceon alliance.* Main dominant: *Salix herbacea.* On late-snow patches. Comp. Gjaerevoll 1950.

A striking contrast to this low alpine poor heath vegetation forms the r i c h h e a t h vegetation on calcareous soils. The *Empetrion* and *Myrtillion* alliances are replaced by a *Dryadion* alliance with *Dryas octopetala* as the main dominant and with a very rich flora

of calciphytes never found in the poor heath vegetation. On the most wind exposed ridges a suballiance *Nardino-Dryadion* is found, with *Carex nardina* and *C. glacialis* as characteristic species, and very wind-eroded *Dryas* carpets. In depressions with good snow protection in winter a suballiance *Tetragono-Dryadion* is found, with *Cassiope tetragona* as a characteristic species. Among the most common species characteristic of the *Dryadion*, *Rhododendron lapponicum* and *Carex rupestris* may be mentioned. See Du Rietz 1942 a.

In areas with too long-lasting snow cover for the *Dryadion*, the *Reticulato-Poion alpinae* alliance (*Poion alpinae* in Du Rietz 1942 b) is developed, with *Salix reticulata* and *Poa alpina* as main dominants mixed with most other species of the *Dryadion*, but with no *Dryas*, no *Rhododendron* and no *Cassiope tetragona*. For details see Gjaerevoll 1950.

In calcareous late-snow patches the *Polarion* alliance, with *Salix polaris* as the main dominant, corresponds to the *Herbaceon* on the non calcareous soils.

In places with moving water in the ground these poor and rich fen alliances are replaced by m e a d o w alliances. In the poor heath series the *Deschampsio-Anthoxanthion* alliance is replaced by an *Athyrion alpestris* alliance or by a *Ranunculo-Anthoxanthion* alliance with *Ranunculus acer* and *Anthoxanthum alpinum* as main dominants, or in in the lower parts of the belt by a *Trollio-Anthoxanthion* alliance (partly corresponding to the *Myrtillion*) with *Trollius europaeus*. The *Herbaceon* is replaced by a *Stellaro-Oxyrion* alliance, with *Saxifraga stellaris*, *Oxyria digyna*, etc. as characteristic dominants. In the rich heath series the

earliest snow-free parts of *Reticulato-Poion alpinae* is replaced by a *Potentilleto-Polygonion* alliance (with *Potentilla Crantzii* and *Polygonum viviparum* as characteristic dominants). The later snow-free parts of the same alliance are replaced by a *Ranunculo-Poion alpinae* alliance (with *Ranunculus acer* combined with many calciphytes) or in the lower parts of the low alpine belt with a *Trollio-Poion alpinae* alliance. The *Polarion* is replaced by an *Oppositifolio-Oxyrion* alliance with *Saxifraga oppositiofolia* as a main dominant.

For details about all these alliances see Gjaerevoll 1950. The new names of the alliances were worked out by Gjaerevoll and myself jointly in 1949—1950.

Mires are common in the low alpine belt. Many types of both rich and poor fen are represented.

The upper limit of the low alpine belt is best drawn after the disappearance of one of its main dominants, *Vaccinium Myrtillus*, usually somewhere between 1050 and 1100 m above sea level. (Du Rietz 1925 a, 1926, 1942 b).

D. The middle alpine belt.

In this belt not only the *Vaccinium Myrtillus* heath but also the willow scrub and the meadows of the low alpine belt have disappeared completely. The *Vaccinium Myrtillus* heath is replaced by *Phyllodoce coerulea* heath, *Cassiope tetragona* heath, *Juncus trifidus* heath etc. The *Empetrum* and *Betula nana* heaths have lost much of their vitality and power of competition, and are invaded by grasses and sedges (*Calamagrostis lapponica*, *Hierochloë alpina*, *Carex Bigelowii*, *Festuca ovina* and *vivipara*, etc.), which are also dominant in

patches. Dwarfed *Vaccinium Vitis-idaea* and *V. uliginosum* are also important dominants, as well as *Cassiope hypnoides* and *Salix herbacea*. *Cassiope tetragona* is the most important dwarf-shrub dominant, often covering much of the ground in this belt. Boulder fields without any vegetation of vascular plants are covering great areas.

A few hundred meters above the *Vaccinium Myrtillus* limit the last patches of *Cassiope tetragona*, *Empetrum*, *Vaccinium uliginosum* and V. *Vitis-idaea* heath disappear, as well as various kinds of grass-heath. The small patches of earth between the boulder fields are now only covered by dwarf willow heath and *Luzula* heath. We have passed the border between the middle and the high alpine belts.

E. The high alpine belt.

In the lower part of the high alpine belt, *Salix herbacea* and, on enough calcareous ground, *S. polaris* are among the main dominants on the small patches, together with *Luzula confusa*, *L. arcuata* and *Ranunculus glacialis*, and a few other plants. Some hundred meters higher up both *Salix* species disappear, and we pass from the *dwarf willow belt* into the *Ranunculus glacialis belt*, with *Ranunculus glacialis*, *Luzula confusa* and *L. arcuata* as the only dominants left. If we climb still a few hundred meters, also these last phanerogams disappear and we pass into the *high alpine belt without vascular plants*. In the Torneträsk district only the summits of the highest amphibolite mountains reach this belt. The last vascular plant is always *Ranunculus glacialis*, reaching 1750 m on the summit of mount

Nissontjårro. *Luzula confusa*, *Lycopodium selago*, *Cardamine bellidifolia*, and *Poa arctica* are usually also among the last vascular plants. Comp. Du Rietz 1925 a, b and c.

As to the very rich lichen and moss vegetation of the high alpine belt see Du Rietz 1925 a and b.

III. The vegetation along the railway Abisko Östra—Narvik and in the Skjomen Fjord.

On July 28, Excursion CIIIc and Excursion CV will go together to Narvik by train and from Narvik with a boat to Elvegård in the Skjomen Fjord, a branch of the Ofoten Fjord S. of Narvik.

Between Abisko Östra (390 m) and Riksgränsen (521.6 m) the railway runs through the subalpine birch forest belt, though only little is left of the birch forest along the western part of the railway. After passing the Swedish-Norwegian border just W. of the railway station of Riksgränsen, the railway descends rapidly. The first pines are seen below the railway W. of the station Hunddalen at ca. 320 m. The upper limit of the pine forest lies much lower here than in the Abisko valley. Much pine forest can be seen along the branches of the Ofoten Fjord. There is no spruce forest at all in this part of Norway. The northernmost spruce forest of the Norwegian western coast grows just S. of the Polar Circle.

Many mountain plants are found in great quantity at sea level in the Ofoten Fjord district.

The Skjomen Fjord is a narrow fjord with steep sides, surrounded by high and much glaciated moun-

tains. The sharp »nunnatakk sculpture» of the high mountain peaks in the Norwegian coast district forms a remarkable contrast to the rounded forms of the lower mountain sides as well as of the mountains on the Swedish side of the border, where even the highest mountains were completely covered by the inland ice during the last glaciation.

A few hours on the shore at Elvegård in the Skjomen Fjord will give the excursion an opportunity of studying the salt-marsh and rocky shore vegetation with Arctic Sea shore plants. The vegetation of the hydrolitoral (= intertidal) belt is differentiated into one lower zone with dominant *Fucus serratus* above the *Laminaria* community of the sublitoral belt, and one upper zone with dominant *Ascophyllum nodosum* and *Fucus vesiculosus*. Above the *Fucus vesiculosus* society there is generally a narrow zone of a *Pelvetia canaliculata* society. In both these societies grows a crustaceous lichen layer of *Verrucaria mucosa* and *V. striatula*. In the lower geolitoral belt (comp. Du Rietz 1950) *Verrucaria maura* forms a very characteristic black society.

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